



The Identification of quantum effects in electronic devices based on charge transfer magnetic field model

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Abstract

The trend of today's electronic developments is the reduction of essential devices and the expansion of their functionality. This creates a demand for new nano-elements that can improve properties with a small amount. The operation of such electronic devices is called quantum effects. Electrons exhibit the properties of particles, and the properties of waves, and thus there are phenomena of charge transfer, which are very important to external influences, especially to electric and magnetic fields. Of particular interest are quantum dot correlations - the correlation width is so small that the electron waves are stacked a few lengths - it is comparable to the size of an atom. In this paper the quantum effects of electronic devices are identified with the help of on charge transfer magnetic field model. If a layer of two-dimensional electronic gas (particles can move freely in only two directions) to connect two large electrodes, such contacts can be obtained, then it is possible and it is provided with a shutter plate. The greater the tension filed, the more restricted the movement of electrons and already interacting.

Keywords: electronic, essential devices, nano-elements, quantum effects, magnetic fields

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1. Introduction

The quantum world is multi-faceted and multi-dimensional, with many classical faces and projections [1]. Two key properties within the framework of the proposed concept are super intuition (i.e. receiving information from anywhere) and the control of subjective reality [2]. In ordinary consciousness, a person can see only one picture of the world and cannot consider two at the same time whereas; in reality there are a large number of them [3]. All these together are the quantum world and

light. Quantum physics teaches a person to see a new reality (although many Eastern religions and magicians have had such a technique for a long time) [4]. It is only necessary to change the human consciousness. Now a person is inseparable from the whole world, but the interests of all beings and things are taken into account [5]. Only then, forced to see all alternatives, does he come to the absolute truth and insight. The principle of life from the point of view of quantum physics is that a



person should, among other things, contribute to a better world order [6 -7].

It is no exaggeration to say that the invention of semiconductor devices was a revolution. Not only was it an impressive technological achievement, but it paved the way for events that would change modern society forever [8-9]. Semiconductor devices are used in all types of microelectronic devices, including computers, some types of medical diagnostic and therapeutic equipment, and popular telecommunications devices [10]. But behind this technological revolution lies even more, a revolution in general science: field quantum theory. Without this leap in understanding the natural world, the development of semiconductor devices (and the development of advanced electronic devices) would never have been successful [11-12]. Quantum physics is an incredibly complex branch of science. This chapter provides only a brief overview [13]. Without a basic understanding of quantum physics, or the scientific discoveries that led to their development, it is impossible to understand how and why semiconductor electronic devices work [14]. Negative electrons surround a small positive nucleus. Protons and neutrons, the smallest particles of matter, make up the nucleus of an atom; Electrons orbit a star like planets [15-16]. The nucleus has a positive charge due to the presence of protons (neutrons have no electrical charge), while the balance of the atom is negatively charged on the orbiting electrons [17]. Negative electrons are attracted to positive protons just as planets are attracted to the sun, but the orbits are stable due to the motion of the electrons [18]. Experimentally the positive charges of the atoms are concentrated in a small, dense nucleus and are not evenly distributed throughout its diameter [19].

The path of some alpha particles is deviated by a large angle. Some alpha particles are backscattered at an angle of nearly 180°. Most of the particles travel through the gold foil unchanged, as if there was no foil at all [20]. Many alpha particles experienced large deviations in their trajectories indicating the

existence of nuclei with a small positive charge. A beam of alpha particles is scattered by a thin gold foil [21]. Although Rutherford's atomic model was better supported by experimental data than Thomson's, it was still imperfect. Further efforts were made to determine the structure of the atom, and these efforts helped pave the way for the strange discoveries of quantum physics. Our understanding of the atom today is somewhat complicated [22]. Despite the revolution in quantum physics and its contributions to our understanding of the structure of the atom, Rutherford's depiction of the solar system as an atomic structure has become so ingrained in popular consciousness that it persists in academic circles. The inward attraction of oppositely charged nuclei is balanced by their motion. The use of the term "centrifugal force" is technically incorrect (even for orbiting planets), but it is easily forgiven because of the popular acceptance of this model: in fact, there is no such thing as a force that repels a rotating body from the center of its orbit. This seems so because the inertia of the body keeps it moving in a straight line, and since orbit is a constant deviation (acceleration) from linear motion, there is a constant inertial reaction to any force that attracts the body to the center [23].

However, the real problem with this explanation at first is the idea that electrons move in circular orbits. It is a proven fact that accelerated electric charges emit electromagnetic radiation, a fact known even in Rutherford's time [24]. Since, the rotational motion is a form of acceleration (an object rotating at a constant acceleration, pulling the object away from its normal rectilinear motion), the electrons in the spinning state must emit radiation like mud from the spinning wheel. Electrons are accelerated along circular paths in particle accelerators known to do this, and the result is called synchrotron radiation.

2. Related Works

According to the laws of classical physics, excited atoms must return energy over an almost infinite frequency range. At selected frequencies. In other words, if Rutherford's

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model were correct, there would be no "tuning fork" effect, and the color spectrum emitted by any atom would appear as a band of continuous colors rather than as several discrete lines [1]. Bohr's model of the hydrogen atom (in which scaled orbital's are drawn) assumes that electrons occupy only discrete orbital's. Electrons moving from $n=3,4,5$ or 6 to $n=2$ are shown in a series of Palmer spectral lines [2]. It suggested that each electron has a specific, finite amount of energy and that their orbital's are distributed in such a way that each of them occupies certain spaces around it. Nucleus is like balls, fixed in circular orbits around the nucleus, not freely moving satellites as previously thought (image above). Respecting the laws of electromagnetism and accelerating charges, the war is referred to as "orbits". Static positions avoid the interpretation that they are mobile [3].

Bohr's ambitious attempt to revise the structure of the atom so closely matched the experimental data, although a milestone in physics did not materialize. This mathematical analysis was better at predicting the results of the experiments than previous models had done, but there were still unanswered questions [4]. The statement that electrons exist in fixed quantum states around the nucleus correlates better with experimental data than Rutherford's model, but does not say what causes the electrons to take these special states. The photons have both the properties of particles and the properties of waves [7]. Based on this assumption, he suggested that an analysis of spinning electrons in terms of waves was superior to that of particles, and could give more insight into their quantum nature. Indeed, another advance in understanding was made [8]. If the electrons lose energy in this way, their orbital's eventually degenerate, resulting in them colliding with the positively charged nucleus. However, this usually does not happen within atoms. Indeed, electronic "orbits" are surprisingly stable over a wide range of conditions. Additionally, experiments with "excited" atoms show that electromagnetic energy is emitted by an atom only at certain

frequencies [10]. Atoms are "excited" by external influences such as light, absorb energy and send back electromagnetic waves at certain frequencies, much like a tuning fork that doesn't tune at a certain frequency. When the light emitted by an excited atom is split into its component frequencies (colors) by a prism, individual lines of colors in the spectrum are observed, the spectral line pattern unique to a chemical element [12]. This phenomenon is commonly used to identify chemical elements and to measure the proportions of each element in a compound or chemical mixture

3. Proposed Model

A string vibrating at a resonant frequency between two fixed points produces a standing wave. The atom had standing waves, a phenomenon familiar to physicists in various forms. Like the plucked string of a musical instrument that vibrates at a resonant frequency, there are "knots" and "anti-knots" at fixed points along its length. Electrons can only exist in specific, specific "orbits" around the nucleus because they are the only distance where the ends of the wave meet. At any other radius, the wave collides destructively with itself, causing it to disappear. provided both a mathematical framework and a convenient physical analogy for explaining the quantum states of electrons within an atom, but his model of the atom was still incomplete.

In essence, quantum mechanics provides the general concepts of absolute state and absolute moment, and replaces them with absolute concepts of types that have no analogues in general practice. Although electrons are known to exist in distorted, "cloudy" forms of distributed probability rather than discrete objects, these "clouds" have slightly different properties. Any electron in an atom can be described by four numerical measurements shown in fig 1;

- Principal numbers
- Orbital numbers
- Magnetic numbers
- Spin numbers



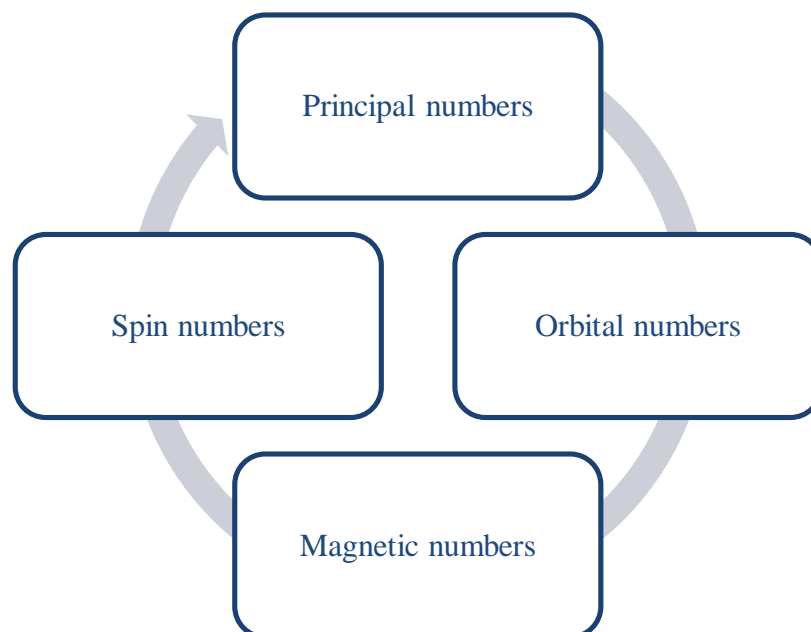


Fig 1: Proposed numerical measurements

3.1. Calculation of Principal numbers

The principal quantum number must be a positive integer (greater than or equal to 1). In other words, the principal quantum number of an electron cannot be $1/2$ or -3 . These integers are not chosen arbitrarily, but by experimental evidence of the light spectrum: the different frequencies (colors) of light emitted by excited hydrogen atoms follow a mathematical relationship with respect to specific integer values. Each shell is capable of holding many electrons. An analogy for electron shells is concentric seats in an amphitheater. A person sitting in an amphitheater has to choose a row to sit in (he cannot sit between rows), the electrons have to "choose" a particular shell to "sit in". Like the rows in an amphitheater, the outer shells hold more electrons than the shells closer to the center. Also, like people in an amphitheater looking for a place near the center, electrons tend to find the smallest available shell. The higher the shell number, the higher the energy the electrons have. The maximum number of electrons any shell can hold is described by the equation $2n^2$, where n is the principal quantum number. Thus, the first shell ($n = 1$) can have 2 electrons; Second shell

($n = 2$) - 8 electrons; and the third shell ($n = 3$) - 18 electrons.

The principal quantum number n and the maximum number of electrons are related by the formula $2(n^2)$. Orbits are not to scale. Electron shells in an atom are denoted by letters rather than numbers. First shell ($n = 1$) K, second shell ($n = 2$) L, third shell ($n = 3$) M, fourth shell ($n = 4$) N, fifth shell ($n = 5$) O, sixth shell ($n = 6$) P, and the seventh shell ($n = 7$) B. Orbital (azimuth) quantum number: A shell composed of sub shells. Some people find it more convenient to think of sub shells as simple sections of tiles, like road dividers. Sub shells are very different. Sub shells are regions of space where electron "clouds" exist, and different sub shells actually have different shapes. The first sub shell is shaped like a ball, which makes sense when visualized in three dimensions as an electron cloud surrounding the nucleus of an atom. The second sub shell resembles a dumbbell with two "petals" attached at a point near the center of the atom. The third sub shell usually resembles a set of four "petals" surrounding the nucleus of an atom. These sub shell shapes resemble graphical representations of antenna shapes

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with onion-like lobes extending from the antenna in various directions.

3.2. Calculation of Orbital numbers

Valid values for the orbital quantum number are positive integers, with respect to the principal quantum number, but also include zero. These quantum numbers for electrons are denoted by the letter l . The number of sub shells is equal to the principal quantum number of the shell. Thus, the first shell ($n = 1$) has a sub shell with number 0; the second shell ($n = 2$) consists of two sub shells numbered 0 and 1; the third shell ($n = 3$) consists of three sub shells numbered 0, 1 and 2. The old sub shell convention used letters rather than numbers. In this form, the first sub shell ($L = 0$) is denoted as s , the second sub shell ($L = 1$) as p , the third sub shell ($L = 2$) as d , and the fourth sub shell ($L = 3$) as f is indicated. With a proton in the nucleus, the atom accepts an electron to balance its charge (the proton's positive charge is exactly balanced by the electron's negative charge). This electron is in the lower shell ($n = 1$), the first sub shell ($l = 0$), in the same orbital of this sub shell ($m = 0$), with a spin value of $1/2$. A common method of describing this structure is to count the electrons according to their shells and sub shells. In this notation, the shell number is shown as an integer, the sub shell as a letter (s, p, d, f) and the total number of electrons in the sub shell (all orbital's, all spins) as a superscript. Hence, hydrogen, with its single electron placed in the ground level, is described as $1s^1$. Moving to the next atom (in atomic number order), we get the element helium: A helium atom has two protons in its nucleus, which requires two electrons to balance the double positive charge. Since two electrons - one spin $1/2$ and the other spin $-1/2$ - occupy the same orbital, helium's electronic structure does not require additional sub shells or shells to hold the second electron. However, an atom with three or more electrons will need additional sub shells to hold all the electrons because the bottom shell can only hold two electrons ($n = 1$).

3.3. Calculation of Magnetic Quantum Number

The magnetic quantum number for an electron characterizes the orientation of the electron sub shell. The "leaflets" of the sub shells can be directed in several directions. These different orientations are called orbital's. For the first sub shell (s ; $l = 0$), which resembles a sphere, the "direction" is not specified. For a second (p ; $l = 1$) each shell has a sub shell that resembles a dumbbell pointing in three possible directions. Imagine three dumbbells intersecting at the origin, each pointing along its own axis in a triangular coordinate system. Valid values for a given quantum number are integers from $-l$ to l , and this number is denoted as m in atomic physics and z in atomic physics. To calculate the number of orbital's in any sub shell, double the number of sub shells and add 1, $(2 \cdot l + 1)$. For example, the first sub shell in any shell ($l = 0$) has an orbital with number 0; the second sub shell ($l = 1$) contains three orbital's with numbers $-1, 0$ and 1 in any shell; the third sub shell ($l = 2$) contains five orbital's numbered $-2, -1, 0, 1$ and 2 ; etc. Like the principal quantum number, the magnetic quantum number arose directly from experimental data: the Zeeman Effect, the splitting of spectral lines by exposing an ionized gas to a magnetic field, hence the name "magnetic" quantum number.

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3.4. Calculation of Spin quantum number

Like the magnetic quantum number, this property of an atom's electrons was discovered experimentally. A closer look at the spectral lines showed that each line was actually a pair of closely spaced lines, the so-called fine structure a result of each electron "spinning" on its own axis like a planet. Electrons with different "spins" give off slightly different frequencies of light when excited. The spinning electron concept is now obsolete, better suited to the (erroneous) view of electrons as individual particles of matter rather than "clouds", but the name remains. Spin quantum numbers are denoted s in atomic physics and s_z in atomic physics. Each orbital in each sub shell can have two electrons in each shell, one with spin $+1/2$ and the other with spin $-1/2$. Lithium uses a fraction of the capacitance L of the atomic shell ($n = 2$). This shell actually has a



total capacity of eight electrons (maximum shell capacity = $2n^2$ electrons). If we consider the structure of an atom with a fully filled L shell, all combinations of sub shells, orbital's and spins are occupied by electrons.

This theoretical progression from de Broglie's primitive standing wave model to the Heisenberg matrix and Schrödinger differential equation models is called quantum mechanics, and it has introduced a startling feature to the world of subatomic particles: the identity of probability, or uncertainty. According to the new quantum theory, it is impossible to determine the exact position and exact speed of a particle at any given moment. A popular explanation for this "uncertainty principle" is a measurement error (ie, by trying to accurately measure the electron's position, you interfere with its velocity, so you can't know what it is before you start measuring the position, and vice versa). A sensational result of quantum

mechanics is that particles do not have exact positions and momentum, and because of the relationship of these two quantities, their combined uncertainty cannot fall below a certain minimum value.

4. Results and discussion

The proposed charge transfer magnetic field model (CTMFM) was compared with the existing variational quantum algorithm (VQA), Randomized Quantum Algorithm (RQA), nearly optimal quantum algorithm (NOQA) and general quantum algorithm (GQA)

4.1. Signal of Infinite duration

A signal of infinite duration (infinite number of cycles) can be analyzed with absolute accuracy, but the fewer cycles available to the computer for analysis, the less accurate the analysis ... The fewer the periods of the signal, the lower its frequency. The comparison between the existing and proposed models is listed the following table 1,

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Table 1: Comparison of Signal of Infinite duration

No of Inputs	VQA	RQA	NOQA	GQA	CTMFM
100	72.43	79.74	78.94	94.57	91.22
200	72.76	81.24	79.53	96.44	92.23
300	74.10	82.35	80.51	97.27	92.39
400	75.24	82.73	81.72	98.18	93.35
500	76.29	83.74	82.86	99.10	92.92
600	77.00	84.67	83.97	100.43	94.12
700	78.30	85.67	84.67	101.51	94.28

Taking this concept to its logical extreme, a short pulse (not even the full duration of a signal) does not actually have a finite frequency; it is an infinite number of frequencies.



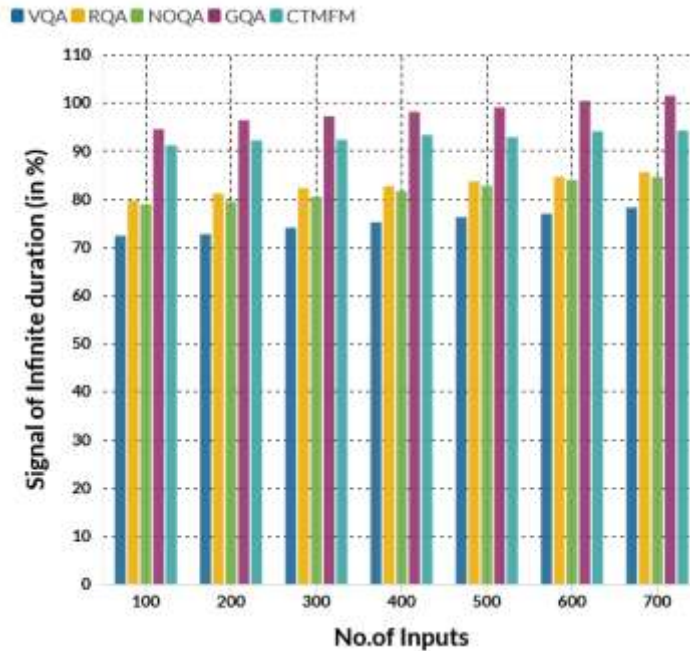


Fig 2: Comparison of Signal of Infinite duration

The fig 2 demonstrates the Comparison of Signal of Infinite duration. This principle is general to all wave phenomena, and not limited to alternating voltages and currents. There is a mutually exclusive relationship between the time domain data of a waveform and its frequency domain data. Simply put, the more we know its component frequencies, the more accurately we know its amplitude over time and vice versa.

4.2. Amplitude of a changing signal

To accurately determine the amplitude of a changing signal, we need to measure it over a very short period of time. However, doing this limits our knowledge of the frequency of the wave (in quantum mechanics a wave need not be the same as a sinusoidal wave; such similarity is a special case). The comparison between the existing and proposed models is listed the following table 2,

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Table 2: Comparison of Amplitude of a changing signal

No of Inputs	VQA	RQA	NOQA	GQA	CTMFM
100	70.13	77.44	82.34	77.31	90.31
200	70.46	78.94	82.93	79.18	91.35
300	71.80	80.05	83.91	80.01	91.48
400	72.94	80.43	85.12	80.92	92.44
500	73.99	81.44	86.26	81.84	92.01
600	74.70	82.37	87.37	83.17	93.25
700	76.00	83.37	88.07	84.04	93.36

On the other hand, to determine the frequency of a wave with great accuracy, we must measure it over a large number of periods, meaning that we lose sight of its amplitude at

any given time. Therefore, we cannot simultaneously know the instantaneous amplitude and all frequencies of any wave with unlimited accuracy.



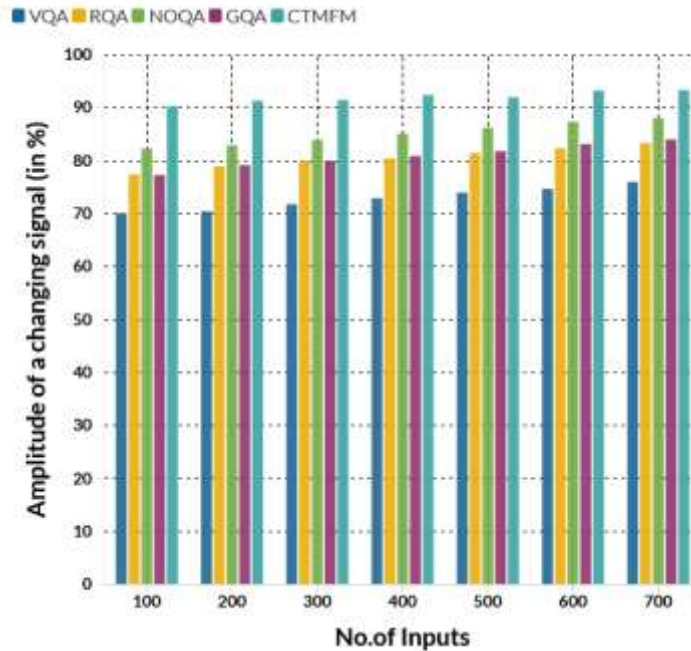


Fig 3: Comparison of Amplitude of a changing signal

The fig 3 demonstrates the Comparison of Amplitude of a changing signal. Another oddity is that this uncertainty is greater than the observer's inaccuracy; it is in the nature of a wave. It is not possible, given appropriate technology, to provide accurate measurements of both instantaneous amplitude and frequency simultaneously. In a literal sense, a wave cannot have exact instantaneous amplitude and exact frequency at the same time.

4.3. Uncertain electron clouds

Table 3: Comparison of Uncertain electron clouds

No of Inputs	VQA	RQA	NOQA	GQA	CTMFM
100	73.18	88.45	76.42	82.34	92.00
200	71.55	86.71	74.84	80.92	90.71
300	71.07	84.37	72.64	79.66	89.70
400	69.78	83.56	71.01	77.67	88.81
500	67.67	81.27	69.87	75.20	88.44
600	66.18	79.34	67.67	73.76	87.40
700	64.37	77.61	66.52	72.04	86.63

Wave functions are probability distributions in which each electron is "scattered" or "smeared out" over a range of states and momentum. This radical view of electrons as uncertain

There is no limit in measurement to the minimal uncertainty of particle position and velocity as expressed by Heisenberg and Schrödinger; rather, it is an intrinsic property of the wave-particle duality of particles. Thus, the electrons are not really well-defined particles of matter or well-defined waveforms in their "orbits," but rather "clouds"—a technical term. The comparison between the existing and proposed models is listed the following table 3,

clouds initially contradicted the original principle of the quantum states of electrons: electrons exist in discrete, definite "orbits" around the nucleus of an atom.



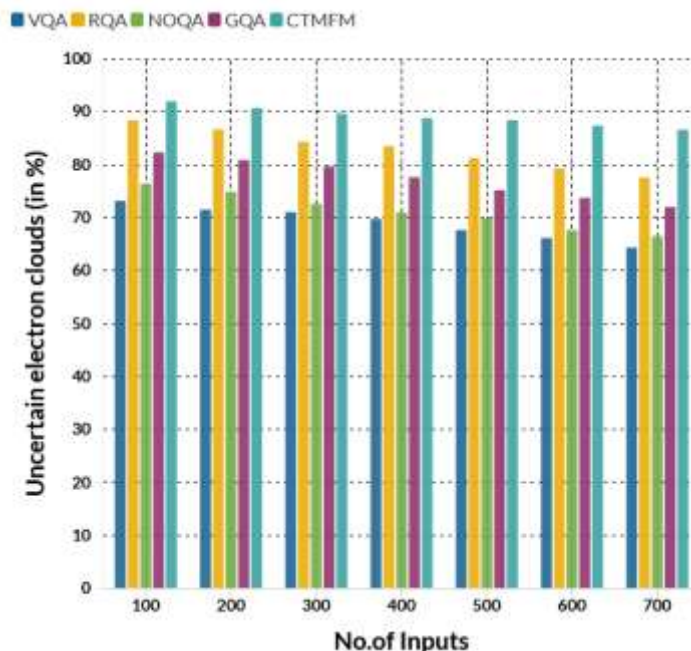


Fig 4: Comparison of Uncertain electron clouds

The fig 4 demonstrates the Comparison of Uncertain electron clouds. This new vision was, after all, the discovery that led to the formulation and interpretation of quantum theory. A theory developed to explain the unique behavior of electrons states that electrons are "clouds" and not discrete particles. However, the quantum behavior of electrons does not depend on electrons having certain values of coordinate and momentum, but on other properties.

4.4. Spectroscopic symbol to an atom

Often, when assigning a spectroscopic symbol to an atom, completely filled shells are omitted, and unfilled shells and upper-level filled shells are indicated. For example, the neon element (shown in the figure above), which has two completely filled shells, can be spectrally described as 2p 6 rather than 1s 2 2s 2 2p 6. The comparison between the existing and proposed models is listed the following table 4,

Table 4: Comparison of Spectroscopic symbol to an atom

No of Inputs	VQA	RQA	NOQA	GQA	CTMFM
100	71.39	69.70	74.78	68.87	90.05
200	73.02	71.44	76.36	70.29	91.34
300	73.50	73.78	78.56	71.55	92.35
400	74.79	74.59	80.19	73.54	93.24
500	76.90	76.88	81.33	76.01	93.61
600	78.39	78.81	83.53	77.45	94.65
700	80.20	80.54	84.68	79.17	95.42

Lithium, with its fully filled K shell and a single electron in the L shell, can be described as 2s 1 rather than 1s 2 2s 1. Avoiding fully populated bottom-level tiles is not just for convenience of

reference. It also illustrates a fundamental principle of chemistry: the chemical behavior of an element is determined primarily by its unfilled shell.



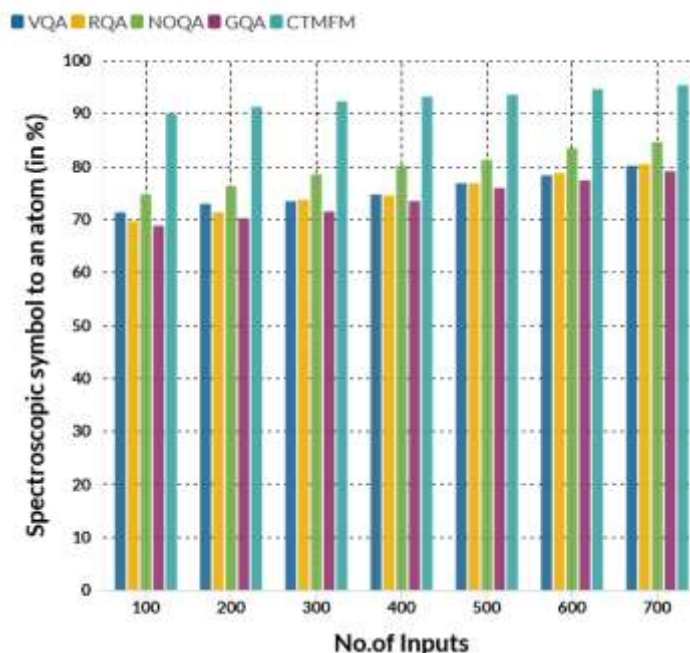


Fig 5: Comparison of Spectroscopic symbol to an atom

The fig 5 demonstrates the Comparison of Spectroscopic symbol to an atom. Both hydrogen and lithium have one electron in their outer shells (1 and 2 v1 respectively), meaning that both elements have similar properties. Both are highly reactive and act in almost identical ways (binding to similar elements under similar conditions). It doesn't really matter that lithium has a fully filled K-shell under an almost free L-shell. It's the unfilled L-shell that determines its chemical behavior. Elements that completely fill the outer shell are classified as noble and characterized by almost complete lack of reaction with other elements.

5. Conclusion

Hypotheses lead to logical conclusions and are accepted, modified or rejected depending on the consistency of experimental data with their conclusions. Any idiot can construct a hypothesis after interpreting the available experimental data, and many do. What distinguish a scientific hypothesis from post hoc speculation is the prediction of future experimental data that has yet to be collected and the consequent refutation of that data. Boldly carry the hypothesis to its logical conclusions and attempt to predict the results of future experiments is not a stubborn leap of

faith, but a public test of this hypothesis, an open challenge to the hypothesis' opponents. In other words, scientific hypotheses are always "risky" because they attempt to predict the results of experiments that have not yet been performed, and therefore are falsified if the experiments do not turn out as expected. Thus, if a hypothesis correctly predicts the results of repeated experiments, it is rejected.

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